DOCUMENT RESUME

ED 271 066 HE 019 447

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TITLE The Effectiveness of Ineffectiveness: A New Approach to Assessing Patterns of Organizational Effectiveness.
INSTITUTION National Center for Higher Education Management Systems, Boulder, Colo.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE Sep 82
CONTRACT 400-80-0109
NOTE 92p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Change Strategies; Evaluation Criteria; *Evaluation Methods; Higher Education; Models; *Needs Assessment; *Organizational Effectiveness; *Problem Solving
IDENTIFIERS *Fault Tree Analysis

ABSTRACT

A way to assess and improve organizational effectiveness is discussed, with a focus on factors that inhibit successful organizational performance. The basic assumption is that it is easier, more accurate, and more beneficial for individuals and organizations to identify criteria of ineffectiveness (faults and weaknesses) than to identify criteria of effectiveness (competencies). An organization is defined as being effective to the extent that it is free from characteristics of ineffectiveness. The technique for assessing and improving organizational effectiveness is called "fault tree analysis." Seven steps used in fault tree analysis when assessing organizational effectiveness include: answer seven critical questions to limit the scope of the assessment, determine the top fault and contributing faults, analyze specifics to identify a change strategy, determine weights for the faults through subjective judgments of importance and frequency, compute primary and secondary strategic paths through logic gates, and identify prioritized change strategies for improving organizational effectiveness. Advantages and disadvantages of fault tree analysis are considered, and an example of a private liberal arts college is used to identify indicators of ineffectiveness. Finally, seven models of organizational effectiveness are compared. (SW)

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THE EFFECTIVENESS OF INEFFECTIVENESS: A NEW APPROACH TO ASSESSING PATTERNS OF ORGANIZATIONAL EFFECTIVENESS

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HE 019 947

September 1982

Preparation of this research was sponsored by the National Institute of Education, contract number 400-80-0109.

ABSTRACT

This essay introduces a new approach to assessing and improving organizational effectiveness. It focuses on the factors that inhibit successful organizational performance rather than on factors that contribute to or indicate successful organizational performance. Its basic assumption is that it is easier, more accurate, and more beneficial for individuals, and organizations, to identify criteria of ineffectiveness (faults and weaknesses) than to identify criteria of effectiveness (competencies). Under this approach an organization is defined as being effective to the extent that it is free from characteristics of ineffectiveness. A technique for assessing and improving organizational effectiveness, called Fault Tree Analysis, is explained and illustrated. Advantages and disadvantages of this technique are discussed relative to research in higher education.

THE EFFECTIVENESS OF INEFFECTIVENESS

Organizational effectiveness is an enigma. On the one hand, it is probably the most central construct in organizational behavior. On the other hand, its definition and meaning are ambiguous, and there has never been agreement on how to measure it. Effectiveness is both apex and abyss in organization behavior research. It is an apex in the sense that all conceptualizations and theories of organizations are aimed, ultimately, at identifying effective performance. It is the fundamental dependent variable in organizational investigations, and judgments of effectiveness and ineffectiveness are an inherent part of the activities of theoreticians, researchers, and practitioners in organizations. It is an abyss in the sense that no valid theories of organizational effectiveness exist in organizational behavior, and no list of criteria has ever been formulated that is either necessary or sufficient for evaluating the construct. Moreover, the judgments of effectiveness made by individuals frequently are based on an unidentifiable set of preferences and assumptions.

In this essay, reasons why organizational effectiveness is enigmatic are discussed first, and it is argued that there are functions as well as dysfunctions in keeping the construct of effectiveness confusing. In the second part of the essay, a new approach to defining and investigating organizational effectiveness is discussed which addresses some of the problems inherent in the construct. and an illustration of the usefulness of this approach in assessing organizational effectiveness is presented. The essay concludes by comparing several major approaches to effectiveness

with this new approach, and suggestions are made of research settings in which each approach is most appropriate.

Reasons For the Enigma

Organizational effectiveness remains an enigma for two primary reasons--one is conceptual the other is empirical. In this section, the conceptual reasons are discussed first followed by the empirical reasons.

Multiple Conceptualizations of Organizations

The construct of organizational effectiveness is closely associated with conceptualizations of organizations. That is, distinctions between effective and ineffective designs, performance, processes, and so forth, are an inherent part of any view of what an organization is. Variety in conceptualizations of organizations, therefore, leads to variety in models and approaches to organizational effectiveness.

Organizations have been conceptualized in numerous ways in the literature of organizational behavior. For example, organizations have been called networks of objects (Tichy & Fombrun, 1979), rational entities in pursuit of goals (Perrow, 1970), coalitions of powerful constituencies (Pfeffer & Salancik, 1978), individual need-meeting cooperatives (Cummings, 1977), meaning-producing systems (Pondy & Mitroff, 1979), information-processing units (Galbraith, 1977), open systems (Thompson, 1967), collegiums (Millett, 1962), garbage cans (March & Olsen, 1976), language games (Wittgenstein, 1968), psychic prisons (Morgan, 1980), machines (Taylor, 1911), social contracts (Keeley, 1980), and so on. Each of these conceptualizations highlights, even uncovers, organizational phenomena that were missed or ignored by the others. Research conducted under these different conceptualizations focuses on different phenomena,

proposes different relationships among variables, and judges effectiveness differently.

In the organizational sciences, however, there simply are no universally accepted conceptualizations of organizations. One reason is that unlike the physical sciences, for example, the worth of conceptualizations of organizations is judged on the basis of their completeness, not on the basis of their accuracy. That is, conceptualizations are accepted if they highlight relevant organizational phenomena previously ignored in other models. The emphasis is on elaborating, not replacing, previous models. In the physical sciences, conceptualizations are accepted if they accurately map the objective world. No conceptualization so far has mapped all the relevant phenomena in an organization, nor have any intended to, and therefore each is inherently incomplete.[1]

This is not to argue, of course, that there should be only one conceptualization of organizations and therefore only one model of organizational effectiveness. In fact, there are important reasons for perpetuating multiple conceptualizations and multiple models of effectiveness. Variety in conceptualizations of organizations serves a useful purpose. Davis (1971) pointed out that what is interesting about organizations can only be uncovered by contradicting commonly held propositions. Rothenburg (1979) discussed Janusian thinking (i.e., holding contradictory thoughts simultaneously in the mind) as the most productive means for scholarly progress. Weick (1977) illustrated a contradictory approach to effectiveness by pointing out contradictory examples of commonly held criteria of smooth functioning organizations. Though organizations are efficient and controlled, for example, they also

are clumsy and wandering. Morgan (1980) pointed out that increased insight can be achieved by using a variety of metaphors to describe organizations. not just one.

> Viewing organizations systematically as cybernetic systems. loosely coupled systems. ecological systems. theaters. cultures. political systems. language games. texts. accomplishments. enactments. psychic prisons. instruments of domination, schismatic systems. catastrophes. etc., it is possible to add rich and creative dimensions to organization theory [p. 615].

Daft and Wiginton (1979) suggested that not only is a single conceptualization impossible because of the limitations of language, or of the symbols used to make sense of organizations. but multiple symbols, models, and metaphors have utility in organizational behavior in capturing the complexity inherent in organizational phenomena.

Some writers on organizational effectiveness have continued to advocate the replacement of other models of effectiveness with their own models (Bluedorn, 1980; Connolly, Conlon, & Deutsch, 1980; Kilmann & Herden, 1976; Price, 1972; Stasser & Denniston. 1979). These arguments have not proven fruitful, however, because the different models are based on different conceptualizations of what an organization is. The differences among the models relate to disparate emphases. not to superiority of one over the other (Cameron and Whetten. 1983). An effective organization-as-social-contract (Keeley, 1980). for example, is not the same as. and may even be contradictory to. an effective organization-as-rational-goal-pursuer (Scott, 1977). The first conceptualization emphasizes an absence of organizational goals and purposes where participant needs are supreme. The second emphasizes the presence of organizational goals and purposes where participant needs are subordinate to organizational accomplishment. Multiple constituency

models of effectiveness (Connolly et. al., 1980; Miles, 1980; Pfeffer & Salancik, 1978) are consistent with the first case, while the goal model (Bluedorn, 1980; Campbell, 1977; Price, 1972; Scott, 1977) follows from the second.

Construct Space

Variety in definitions and approaches to organizational effectiveness results not only from association with different conceptualizations of organizations, but also from its nature as a construct. Constructs in the social sciences are abstractions that give meaning to ideas or mental images, but they have no objective reality. They exist in the minds of individuals, and they are only inferred from observable phenomena. Other examples of constructs are leadership, intelligence, satisfaction, and motivation.[2] It is inherent in the definition of a construct that the total meaning of the phenomenon can never be completely circumscribed. That is, the necessary and sufficient evidence for identifying the presence of a construct cannot be explicated because the meaning of constructs is, ultimately, a product of mental imagery. When identifying constructs in the objective world, individuals may arbitrarily select indicators of the construct, or they may substitute the construct with a concept (i.e., with a more narrow phenomenon that has an objective referent outside the mind of the individual). However, these indicators and concepts may not be the same across individuals, and there is no comprehensive list that must be used by everyone.

Compare the construct of organizational effectiveness with the construct of insanity, for example. In both cases, individuals may observe similar phenomena but make disparate judgments about whether the phenomena indicate the presence of the construct. When asked to identify

indicators of these constructs, widely differing lists may be produced. even by experts. And, as evidenced by the case of John Hinkley Jr.'s insanity verdict in 1982, when judgments are made about the presence or absence of these constructs. contradictory opinions about the accuracy of those judgments are probable.

The construct of organizational effectiveness is enigmatic, then, because judgments of effectiveness are made regularly by people, but there are no consensual criteria available upon which to make those judgments. Limited agreement has been reached on some criteria by some individuals. but the agreement is by no means universal. Therefore. advocates of the goal model (Bluedorn, 1980; Price, 1972). the system resource model (Seashore & Yuchtman, 1967). the internal processes or maintenance model (Bennis, 1966; Nadler & Tushman, 1980), the strategic constituencies model (Connolly, et. al., 1980; Kelley, 1978; Pfeffer & Salancik, 1978). the legitimacy model (Miles & Cameron, 1982; Zammuto. 1982). and the competing values model (Quinn and Rohrbaugh, 1982) all are correct in some circumstances. But none of these models captures the total construct space or the total meaning of effectiveness. Whereas each is valuable in its own right because it includes distinctions absent in the others. none has enough explanatory power to supercede other approaches.

This implies that the "construct space" of organizational effectiveness cannot be totally mapped. And when advocates of various approaches to effectiveness adopt one exclusionary stance--that is. when their model is presented as the necessary and sufficient one--motivation to map more of the construct space is inhibited. Effectiveness, then, should be treated as representing an unmapped terrain where different

approaches and models add to the completeness of the map, and debates about the accuracy of one viewpoint versus another are put aside.

Preference-Based Criteria

This construct characteristic of organizational effectiveness leads to the second major reason for its being enigmatic: the importance of measuring effectiveness in organizations but the inability to identify criteria precisely. It is to be expected that when the construct space of effectiveness is unclear, its measurement also will be unclear. But, empirically, the reason that consensual criteria for assessing effectiveness have not been produced is that organizational effectiveness is inherently subjective--that is, it is based on the personal values and preferences of individuals. There are several difficulties with attempting to assess individual preferences and values in research on effectiveness. One problem is that individuals have difficulty explicating their preferences. Nisbet and Wilson (1977) and Slovic and Lichtenstein (1971) each reviewed a large number of empirical studies and drew the conclusion that individuals are not good at specifying their preferences. Individuals' behavior or judgments, and the criteria upon which those behaviors and judgments are based. are not tightly coupled (see, also, Argyris and Schon, 1978, for a discussion of the distinction between theories-in-action and theories-in-use).

Another problem with assessing preferences is that preferences are not stable. They may change to justify previous behavior, in response to organizational life cycle development. or as different constituencies achieve power. For example, a great deal of research in social psychology has demonstrated that preference changes frequently follow from behavior changes (see Brehm & Cohen, 1962, and Sherwood, Barron. & Fitch, 1969, for

reviews). Cameron and Whetten (1981). Miles and Cameron (1982), and Quinn and Cameron (1982) found evidence that changes in preferences related to effectiveness occurred as organizations progressed through their life cycles. MacDonald (1975), Miles and Cameron (1982), and Zammuto (1982) pointed out examples of changes in preferences as a result of different constituencies in organizations obtaining more (or less) power. Changing preferences can complicate the assessment of organizational effectiveness. therefore. because depending on when the assessment is made, the relevant criteria of effectiveness may differ markedly. The relationships among criteria at two different points in time often are not clear. so that effectiveness in the past may not be a good predictor of effectiveness in the present or the future.

A third problem with preferences that inhibits consensual criteria in assessing effectiveness is that individuals. and organizations. may hold contradictory preferences simultaneously. That is. they may pursue two mutually exclusive. desirable end states (e.g., to increase adaptability and therefore slack resources in the organization and. at the same time, to improve efficiency and therefore to decrease slack resources). Cameron's (1981) research on colleges and universities. and Miles and Cameron's (1982) investigation of the U.S. tobacco industry illustrate how organizations pursue criteria of effectiveness that conflict with one another. In these organizations, and in others. contradictory preferences for effectiveness in organizations led to "incrementalism" (i.e., trading off one set of preferences against another; Lindblom, 1959). "satisficing" (i.e., fulfilling all preferences to only a limited extent; Simon. 1947). or "sequencing" (i.e., alternating emphasis among preferences; Cyert & March, 1963). Identifying accurate criteria of effectiveness under these

conditions is difficult, however, because it is not clear which preferences are being advanced.

In addition, several studies have found that different constituencies hold preferences that are negatively related to one another (Dubin, 1976; Friedlander & Pickle, 1968; Rohrbaugh, 1981; Whetten, 1978). This incompatibility of constituency preferences makes it difficult to identify which individuals should specify criteria of effectiveness. Since all possible constituencies can never be tapped, and since the preferences both within and between constituencies frequently conflict, it often becomes an arbitrary choice of the researcher to select preferences that are easily accessible or that have been used in other investigations.

On the other hand, multiple and contradictory preferences may serve a useful purpose because they allow organizations to be judged effective--and consequently to acquire needed resources from various constituencies--even though widely different types and levels of performance are displayed. Variety in preferences contributes to discretion and freedom of action for organizations because they are bound to "satisfy some of the people some of the time" no matter what they do. In addition, they are provided with the freedom to manage the image or impressions of effectiveness, regardless of levels of objective performances (Pfeffer, 1981). It is this variety in performance, in the population ecology view, that enhances the probability of organizational survival (Hannan & Freeman, 1977).

Empirically, organizational effectiveness is enigmatic, therefore, because it is based on individuals' subjective preferences. Because these preferences are unstable, contradictory, and multiple, it is difficult to precisely measure effectiveness in organizations. But this unstability,

contradiction, and multiplicity may actually enhance the effectiveness and survival of the organizations themselves.

This enigma in organizational effectiveness has led to severe, but justifiable, criticism of the research conducted on the subject. In the past two decades, at least eight books have been produced on the subject of organizational effectiveness (Cameron & Whetten, 1983; Ghorpade, 1970; Goodman & Pennings, 1977; Mott, 1972; Price, 1968; Spray, 1976; Steers, 1977; Zammuto, 1982). Without exception, each begins by pointing out the conceptual disarray and methodological ambiguity surrounding this construct. In addition, several hundred articles and book chapters have been written in that period (see Cameron, 1982, for a comprehensive bibliography), and almost all acknowledge that little agreement exists regarding what organizational effectiveness means or how to properly assess it. The writing has been fragmented, noncumulative, and frequently downright confusing. Some writers have become so discouraged by the literature on effectiveness that they have advocated abandoning the construct altogether in scholarly activity (Hannan & Freeman, 1977b). Goodman, (1979a) for example, asserted that "there should be a moratorium on all studies of organizational effectiveness, books on organizational effectiveness, and chapters on organizational effectiveness (p. 4)."

This abandonment of organizational effectiveness, of course, is both impossible (i.e., it is a construct that is firmly embedded in both scholarly and lay language) and unwise (i.e., it serves as an important variable in research and as an important construct in interpreting organizational phenomena). However, some suggestions for improving research on organizational effectiveness are needed given the confused state of the literature. In the next section of this essay, a new

approach to assessing effectiveness is introduced and an alternative working definition of the construct is proposed. This suggestion is not to be construed as a replacement for other approaches and definitions. rather it is an alternative that helps address some of the problems faced by past researchers. and it provides practical guidelines for those faced with evaluating and improving effectiveness. It also holds certain advantages over many of the approaches to assessing effectiveness currently being used.

Organizational Effectiveness As A Fault Tree

This alternative approach to organizational effectiveness focuses on the factors that inhibit successful organizational performance rather than on the factors that contribute to or indicate successful organizational performance. It is based on the notion that it is both easier and more accurate for individuals. and organizations. to identify criteria of ineffectiveness--that is. faults or weaknesses--than it is to identify criteria of effectiveness--that is. competencies or desirable outcomes. This alternative approach merges the "critical questions" in assessing effectiveness advanced by Cameron and Whetten (1983) with "fault tree analysis" (Haasl, 1965)--a procedure developed to analyze systems in the field of safety engineering.

The explanation of this alternative approach to organizational effectiveness first considers the advantages of focusing on ineffectiveness as opposed to effectiveness in assessments of organizations. Second. the history and development of fault tree analysis is briefly explained. and an explanation is provided for how to construct and analyze fault trees in assessing organizational ineffectiveness. Third. the advantages and disadvantages of this approach are discussed in

comparison to other common approaches to effectiveness. Finally, an example of the actual use of fault tree analysis in analyzing an organization is provided for illustrative purposes.

Advantages of Ineffectiveness

The difficulty of identifying appropriate criteria stands as the single most important problem in organizational effectiveness research (Brewer, 1982; Cameron, 1978; Campbell, Brownas, Peterson, and Dunette, 1974; Nord, 1982). Most of the criticism of the literature has focused on the reliability, validity, and generalizability of the criteria used in assessments. One reason for this difficulty in identifying criteria is, as discussed above, the nature of the construct itself. Another important reason pointed out earlier is the difficulty individuals encounter in trying to identify indicators of success. Van de Ven and Ferry (1980) found, in attempting to generate criteria of effectiveness among constituencies in the Wisconsin Job Service and in some Texas child-care organizations, for example, that individuals had great difficulty producing effectiveness criteria "because users had not operationalized their value judgments in their own minds . . . [and] as might be expected, users found it impossible to formulate criteria they would use to measure intangible goals [p. 46]." Van de Ven and Ferry concluded that "users could not break out of their reactive role and proact by generating new effectiveness measures, even when asked to do so but not provided with a process for doing so . . . . [p. 47]."

Shulz, Greenley, and Peterson (1982) discovered, in their study of hospital effectiveness, that respondents found it much easier to identify weaknesses (or indicators of ineffectiveness) than strengths of their

organization (or indicators of effectiveness). Generating criteria indicating success was a major obstacle for respondents.

It also has been discovered that organizational change and improvement is motivated more by knowledge of problems than by knowledge of successes. Negative feedback is more conducive to advancement than is positive feedback. For example, Hirschman and Lindblom (1962) studied decision making in public administration, international economic development agencies, and research and engineering programs and concluded that the stress produced by negative performance feedback was the necessary precondition for organizational learning. Cangelosi and Dill (1965), in an investigation of simulated business firm performance concluded: "Failure, we agree, leads to change. The consequences of success, we argue, are less clear [p. 196]." Miles and Randolph (1980) found similar associations between organizational learning, organizational effectiveness, and negative feedback about performance. Individuals took more responsibility for organizational outcomes when negative information was received instead of positive information, coordination of tasks became more advanced in organizations receiving negative information than among those receiving positive information, and faster and greater quantities of organizational learning were present in organizations receiving negative performance feedback compared to those receiving positive performance feedback. DeNisi, Randolph, and Blencoe (1982) concluded after a study of the effects of feedback on individual and group performance:

> It is noteworthy that...objective performance actually improved significantly following negative individual level feedback from peers, and negative group level feedback from a superior [p. 178].

These empirical results are consistent with common experience which indicates that individuals have an easier time identifying faults than positive traits in others. as well as in themselves. they are motivated to improve their own behavior more readily when weaknesses rather than strengths are pointed out. and negative feedback is given much more attention than is positive feedback when received from significant others. Stephens (1976) concluded that individuals are also prone to reach agreement more easily on characteristics of failure than on characteristics of success.

> Analysis in terms of success, however, is much more problematic than analysis in terms of failure. Not only is it difficult to achieve consensus as to those design characteristics and functions, the channels and interactions, which lead to system success, but experience has shown that in complex systems, it is much easier to describe and achieve consensus as to what constitutes failure. When a system is functioning smoothly, it is not at all easy to specify precisely what combinations of events contribute to this state. But when breakdowns occur, they are immediately apparent, although their causes and their "downstream" effects may be more obscure [p. 3].

All this is to say that the construct space of <u>ineffectiveness</u> appears to be more narrow and more easily mapped than is the construct space of <u>effectiveness</u>. Preferences are more easily identified. Moreover, there is evidence to suggest that organizational improvement is more likely when knowledge of faults is present than when knowledge of successes is present.[3] It seems reasonable to suggest, then, that an approach to assessing organizational ineffectiveness instead of effectiveness may prove beneficial in increasing understanding of organizational performance and in helping to improve organizational functioning. Under this approach organizational effectiveness takes on

the following definition: An organization is effective to the extent that it is free of characteristics of ineffectiveness.[4]

A particular technique for analyzing organizational ineffectiveness has been developed in the field of safety engineering, but it has not been applied widely in the organizational sciences. This technique, called fault tree analysis, is explained in some detail in the paragraphs below.

An Explanation of Fault Tree Analysis

Fault tree analysis provides a well-developed procedure for systematically identifying indicators of ineffectiveness. The criteria of ineffectiveness are the faults, weaknesses, or major problems exsiting in an organization. The analysis focuses on these faults, therefore, instead of on indicators of organizational success. Fault tree analysis is generally thought of as a procedure for increasing the likelihood of success in any system by analyzing the most likely causes of failure (Stephens, 1972). It is a technique of reliability analysis used to diagnose potential or real problems in systems. Unlike conventional forms of reliability analysis in systems engineering, fault tree analysis relies on deductive processes rather than inductive processes. That is, conventional reliability analysis techniques are concerned with assuring that all discrete parts of a system will reliably accomplish their assigned functions (e.g., do all elements in a light bulb work properly?). Fault tree analysis is concerned with relating a single fault or failure to the various parts of a system that may be casually connected (e.g., what factors are related to the light not turning on?).

Fault tree analysis was developed by H. A. Watson at Bell Laboratories in 1961 (Fussell, Powers, Bennetts, 1974). Its original purpose was to evaluate the safety of the Minuteman Launch Control System

in order to prevent the accidental launching of a missile. The applicability of fault tree analysis to the aerospace industry was recognized by individuals at North American Aviation (Hiltz, 1963) and at Boeing Company, so that in 1965 a symposium was held to introduce the technique to a wider audience and to acquaint others with refinements and modifications (Mearns, 1965; Haasl, 1965; Michels. 1965; Nagel, 1965; Feutz & Waldeck, 1965). Fault tree analysis became an accepted technique of reliability analysis in safety engineering over the next ten years. but its application stayed mostly in the area of non-human systems. Most of the literature produced on the technique was discussions of quantification advancements and computer program refinements. Until the mid-1970's. there were almost no applications of fault tree analysis to systems involving human behavior, mainly because of the unreliability of predicting failures in that behavior.

However, beginning with the first application of fault tree analysis outside the field of safety engineering by Witkin and Stephens (1968) in the Alameda County vocational education program in California, a number of doctoral dissertations in the field of educational administration have been written using fault tree analysis. These were written largely under the tutelage of Kent Stephens, a former member of the Boeing aerospace group (see references for a listing of the dissertations). No research other than those dissertations has been published related to behavioral systems to date. however. Furthermore, none of those applications were concerned explicitly with evaluating organizational ineffectiveness. Instead. most focused on more narrow phenomena such as teacher turnover, student self-confidence, management behavior, and so on. The use of fault

tree analysis in effectiveness research, therefore, is largely virgin territory.

In order to understand this technique and its applicability to the assessment of ineffectiveness, the components of fault tree analysis and the procedures used to construct fault trees are explained below.[5] (For a more detailed discussion on this technique see references to fault tree analysis at the end of this essay.)

Critical Questions in Assessing Ineffectiveness

Prior to constructing a fault tree--that is, prior to identifying faults or problems in an organization--analysts must consider seven critical questions that both define and circumscribe the scope of the analysis. No study of effectiveness or ineffectiveness can include all possible criteria from all possible points of view, so some way must be found to specify precisely what the study does and does not include. Seven critical questions discussed in Cameron and Whetten (1983) serve as guidelines for circumscribing assessments, and they have particular relevance when constructing fault trees. The critical questions are as follows.

Question 1: From whose perspective is ineffectiveness being judged?

Ineffectiveness must be defined and assessed from someone's viewpoint, and it is important that the viewpoint be made explicit. The criteria used by different constituencies to define ineffectiveness may differ markedly, and there are no agreed upon decision rule's available to identify one constituency's criteria as being more important than another constituency's criteria. Organizations never satisfy all their constituencies, and what appears to be high effectiveness from one point

of view may be interpreted as being mediocre or low effectiveness from another point of view. The specific point of view being accepted, therefore, must be made explicit.

Question 2: On what domain of activity is the analysis focused?

Domains arise from the activities or primary tasks that are emphasized in the organization, from the competencies of the organization, and from the demands placed upon the organization by external forces (Cameron, 1981; Meyer, 1975). A variety of domains can be identified for almost all organizations, but no organization is maximally effective in all its domains. Moreover, the relevant criteria to be considered often differ markedly in one domain versus another. It is important, therefore, that the particular domain(s) to be assessed be clearly specified.

Question 3: What level of analysis is being used?

Judgments of ineffectiveness can be made at the individual level of analysis, at the subunit level, at the organization level, at the population or industry level, or at the societal level. Although ineffectiveness on each of these different levels of analysis may be interrelated, often it is not, and ineffectiveness on one level may be independent of ineffectiveness on another level. Without attention being paid to which level of analysis is most appropriate, meaningful judgments of ineffectiveness cannot be made.

Question 4: What is the purpose for assessing ineffectiveness?

The purpose(s) for judging ineffectiveness almost always affects the judgment itself. For example, Brewer (1982) pointed out that changing the purposes of the evaluation creates different consequences both for the evaluator and for the unit being evaluated. Different data will be made available, different sources will be appropriate, different amounts of cooperation or resistance will be encountered, and different types of assessment strategies will be required all as a result of differences in purpose (also see Argyris, 1970). Sometimes the analyst can determine his or her own purposes, but frequently the purposes for judging ineffectiveness will be prescribed a priori by the client, the participants in the evaluation, or the external environment. Whatever the case, a clear conception of purpose is critical.

Question 5: What time frame is being employed?

Selecting an appropriate time frame is important because long-term ineffectiveness may be incompatible with short-term ineffectiveness. Some organizations, for example, may tolerate short-term ineffectiveness in order to obtain long-term effectiveness, or vice versa, so that not being clear about what time frame is being employed could severly handicap an assessment. Judgments of ineffectiveness are always made with some time frame in mind, so it is important that the time frame be made explicit.

Question 6: What type of data are being used for judgments of ineffectiveness?

This involves a choice between using information collected by individuals outside the organization with that collected by individuals inside the organization itself. In addition, it involves a choice between objective data (e.g., organizational records) or subjective, perceptual data (e.g., interviews or questionnaire responses). Data collected inside the organization has the advantage of being more fine-grained, detailed, and potentially more accurate than data collected outside the organization, but it also may be more biased and partial, especially regarding areas of weakness. Data collected from individuals outside the organization has the advantage of assessing the public image and effects of organizational action, but it also may miss important phenomena without an insider's view.

Objective data have the advantage of being quantifiable, potentially less biased than individual perceptions, and representative of the official organizational position, but often they are unavailable. The advantage of the subjective or perceptual data is that a broader set of criteria of ineffectiveness can be assessed from a wider variety of perspectives. In addition, operative criteria or theories-in-use (Argyris & Schon, 1978) can more easily be tapped. The disadvantages, however, are that bias, dishonesty, or lack of information on the part of the respondents may hinder the reliability and validity of the data. The selection of data by which to judge ineffectiveness is important because perceptions may generate one set of criteria of ineffectiveness while objective data may indicate a totally different set (see Hall & Clark, 1970, for an example).

Question 7: What is the referent against which ineffectiveness is judged?

There are a variety of referents or standards against which to judge organizational performance. For example, one alternative is to compare the performance of two different organizations against the same set of indicators (comparative judgment). A second alternative is to select a standard or an ideal performance level and then compare the organization's performance against the standard (normative judgment). A third alternative is to compare organizational performance on the indicators against the stated goals of the organization (goal-centered judgment). A fourth alternative is to compare an organization's performance on the indicators against its own past performance on the same indicators (improvement judgment). A fifth alternative is to evaluate an organization on the basis of the static characteristics it possesses, independent of its performance on certain indicators (trait judgment). Effective organizations are judged to possess these characteristics. Because judgments of ineffectiveness can differ markedly depending on which referent is used, it is important to be clear about the referent that serves as the basis for those judgments.

As a result of answering these seven questions at the outset of an assessment, the analyst can determine how detailed the fault tree analysis should be, for whom the fault tree analysis will be most useful, and the types of procedures to be used in gathering information for the construction of a fault tree. Once those answers are specified, formal fault tree analysis can proceed.

Identification of Criteria of Ineffectiveness

The first step in constructing a fault tree involves the identification of "top faults" (also called undesired events or critical

failures). A top fault is a summary statement of the most crucial problem in the organization. The top fault may be a compilation of several related, but more minor problems, or it may stand alone. It is essentially the answer to the question: "What is it that keeps this organization from being what it could be?" or "What is the major indicator of organizational ineffectiveness?" The top fault should be a problem that directly inhibits the organization from being more effective (i.e., it keeps the the organization from acquiring needed resources, from satisfying constituencies, from attaining goals, or in other ways inhibited from being judged as effective). In any given organization, there may be several top faults, but the number of top faults considered should be limited in an analysis since a separate fault tree must be drawn for each top fault.

A top fault should be identified through the use of a consensus building technique such as nominal group or delphi--where a variety of individuals identify what they consider to be the top fault(s), and then a consensus is reached. Or a critical incident methodology (Tarrant, 1963) may be used where individuals are asked to agree on a critical failure event or problem in the organization's past that led to ineffectiveness. The top fault may identify a problem that could exist to make the organization ineffective, but doesn't exist at present. This is the general approach in safety engineering (e.g., the radar system could fail). It may identify a past problem that is no longer directly present (e.g., there was a black-out power failure in New York in 1975). Or it may identify a current problem that inhibits the organization from being effective (e.g., profitability is declining). It is this last alternative that is preferred in assessing organizational ineffectiveness. Once the

top event has been determined, it is placed at the top of the fault tree. and analysis proceeds deductively.

After identifying the single most important top fault, the next step in the analysis is to identify "primary faults," or factors that contribute to the occurrence or presence of the top fault. These should be factors that are directly related to the top fault in time, in space, or in other ways. This step is a critical one because it is the primary faults that compose the branches of the fault tree. Therefore, selecting the appropriate data sources (see critical questions 1 and 6 above) is an important consideration. Fault tree analysis is designed not to analyze all possible contributing factors to the top fault, just those that are major and directly related.

One way to generate valid and reliable primary faults is to ask a group of experts--those who know well the domain being assessed--to identify the factors contributing to the top fault. Another is to analyze critical incidents as a way to discover primary faults. Other sources may be organizational records or theoretical relationships among factors shown by past research to be significant in contributing to the problem. Factors outside the organization, as well as those inside, should be considered. Because the primary faults must be directly related to the top fault, it is important that individuals who identify them be familiar with the processes present in the organization. A broad representation of viewpoints is generally desirable, although it is not a prerequisite (Stephens, 1976).

Van de Ven and Ferry (1980) pointed out that it is frequently easier for individuals to identify the factors that cause or predict effectiveness than to identify the factors that indicate effectiveness

themselves. They suggested that people generally carry around with them a model of why their organization is or isn't effective. In terms of fault tree analysis, this suggests that primary faults may be readily recoverable from the minds of experts without having to go through a rigorous system analysis. The application of fault tree analysis in a limited number of educational settings confirms this notion (see references). Whereas identifying the primary faults for a complete fault tree is generally time consuming, it is by no means an unreasonable task (see, for example, Barker, 1976, and Driessen, 1971).

The primary faults that directly contribute to the top fault are listed directly below it in the tree, and they constitute the second level of the fault tree. Each of the second level primary faults is then analyzed separately, so that the factors that contribute to their presence or occurrence in the organization are identified. That is, the analysis takes this form: the failure of A is due to B1, B2, B3, . . . BN; the failure of B1 is due to C1, C2, C3, . . . CN; the failure of C1 is due to D1, D2, D3, . . . DN; and so forth.

Faults on lower levels of the tree are more specific and precise than are faults on higher levels of the tree. The accuracy of fault tree analysis is generally enhanced if all primary faults on one level are identified before going on to the next level. The number of primary faults that are analyzed as contributing causes, and the level of detail pursued, are determined by the answers to the seven critical questions discussed above (e.g., the purpose of the assessment, the domain of analysis being considered, and so on), by the amount of information available regarding the primary faults, and by the amount of information needed to overcome or solve the top fault. Analysis can stop when

specific change targets have been identified. Elementary fault trees may have only three or four levels of primary faults. complex trees may have as many as 16.[6] Each primary event need not be developed to the same level of specificity as others. however, so that a fault tree may have some branches with few levels and other branches with many.

Relationships Among Criteria of Ineffectiveness

The key to fault tree analysis. and what makes it unique among other reliability analysis techniques. is the connections made among faults on lower levels of the tree with faults on higher levels. These connections occur through "logic gates" derived from Boolean algebraic expressions. The Boolean logic gates most frequently used are the AND and OR expressions. The AND logic gate is used when two or more faults coexist in order to produce a more general fault. It is symbolized by the following figure: . This gate is used only if all the faults are present simultaneously in order to produce a more general fault. Its use is illustrated in Figure 1. In this illustration. fault A is present only if faults B and C coexist.

FIGURE 1 ABOUT HERE

The OR gate is much more common in behavioral systems. and it refers to the condition where any one fault on a lower level could produce the more general fault above it in the fault tree. The graphic symbol for the OR gate is . Figure 2 illustrates its use. In this illustration. fault A is produced by either fault B

FIGURE 1 ILLUSTRATION OF THE AND LOGIC GATE

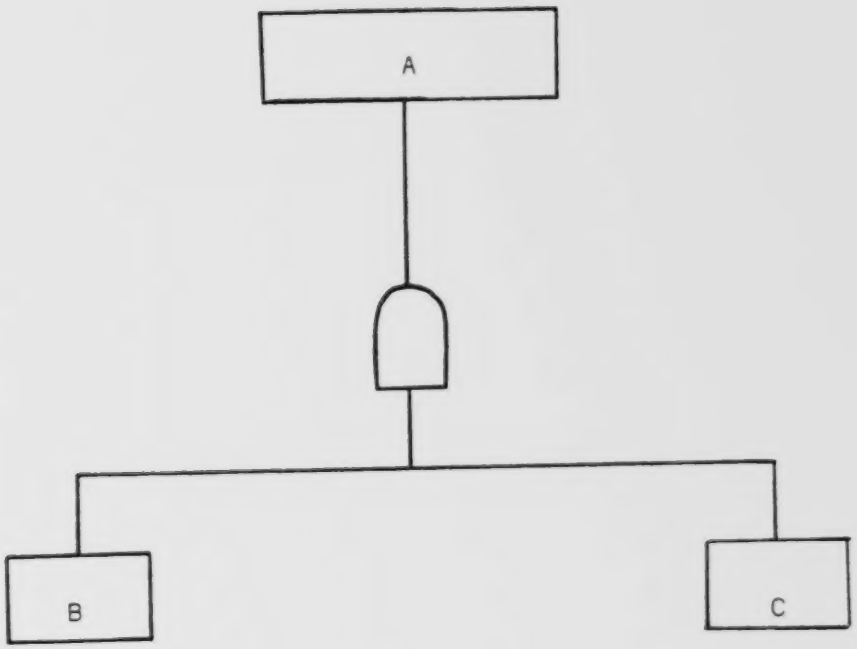

FIGURE 2 ABOUT HERE

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or fault C. An inclusive OR gate indicates a situation where B or C or both could produce A (i.e., faults are nonmutually exclusive). An exclusive OR gate indicates a situation where B or C but not both could produce A (i.e., faults are mutually exclusive).

In addition to logic gates, the other types of symbols used in fault tree analysis identify the nature of the actual faults themselves. These symbols are derived from system safety engineering and are used to show the kind of primary faults that compose the fault tree analysis. There are five common types of symbols.

A rectangle ( ) is the most common symbol, and it signifies a fault that results from a combination of less general faults through a logic gate. A circle ( ) signifies a fault that is at the lowest (most specific) level of analysis on the fault tree. It is a "bottom" fault. A rhombus ( ) signifies a fault that cannot be developed further because of lack of information, a remote possibility of occurrence, or some other constraint. It also is a "bottom" event, but not because it is sufficiently developed. A house ( ) signifies a fault that is not normally a fault. It is a factor that is present in the organization, but it does not usually indicate ineffectiveness. When combined with other faults in the tree, however, it contributes to the occurrence of a more general fault. A triangle ( ) is used to indicate that a particular fault is developed further at another place in the fault tree diagram. For example, a fault may contribute to more than one general fault and so is listed more than once in the tree.

FIGURE 2 ILLUSTRATION OF THE OR LOGIC GATE

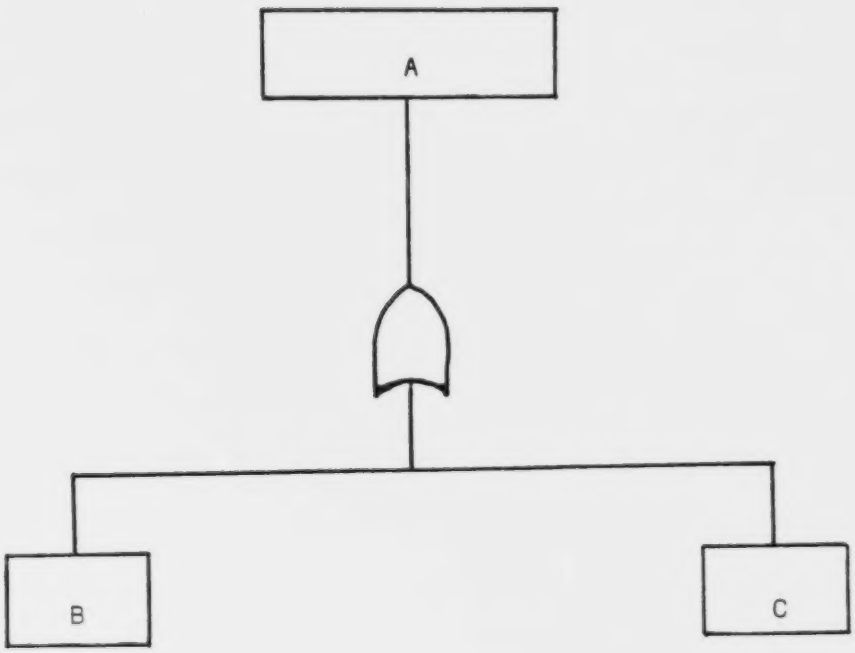

Figure 3 illustrates the use of each of these symbols in a fault tree. The tree in the figure has three branches and three levels. and it is interpreted as follows: Fault A is produced by either

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FIGURE 3 ABOUT HERE

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faults B, C. D, or any combination of the three. Fault B is produced by faults E and F. Fault C is produced by faults G or H or both. Fault D is developed further at another place in the tree (not shown). Faults E and G are developed as specifically as is needed in the three. Fault F is not analyzed further because of some constraint in the analysis. Fault H is not normally an indicator of ineffectiveness. but it does contribute to the presence of fault C.

After constructing a fault tree. an additional procedure is desirable to help assure that the tree is accurate and as complete as possible. Experts should be asked to answer the following questions about each of the faults:

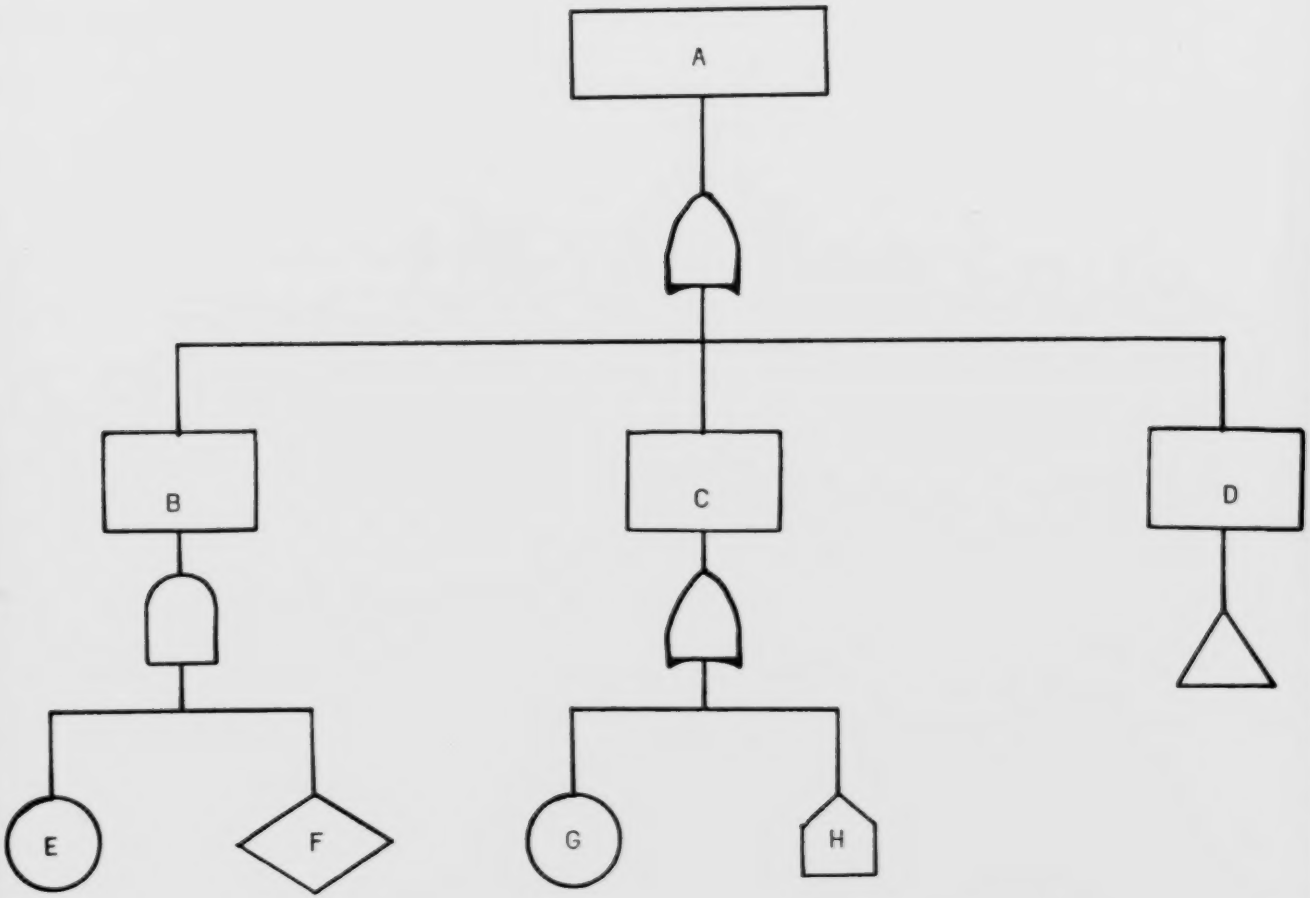
(1) Is this an indicator of ineffectiveness in the organization? Is it a problem that stands in the way of successful performance?

(2) Are all its major contributing factors (primary faults) listed below it?

(3) Do the connecting logic gates accurately characterize the relationship of the primary faults to the more general fault above them?

The advantage of conducting a fault tree analysis in assessing ineffectiveness is that relationships among problems within the

FIGURE 3 AN ELEMENTARY FAULT TREE DIAGRAM



organization are identified, and insights not normally apparent often emerge. Because a variety of alternative "causes" are generated, the risk of inaccurately judging a single cause and effect relationship is minimized. Moreover, because faults (or evidence of ineffectiveness) are being considered and not successes (or evidence of effectiveness), more specificity can generally be achieved. Stephens (1976) suggested additional advantages of this process as well.

> Recent work with FTA [fault tree analysis] of complex systems, however, has shown that failure analysis gives perspectives on a system which go beyond the simple logical inversion of success analysis to failure analysis and back again. In fact, the FTA methodology itself appears to have a heuristic value, both for those participating in the analysis and the managers and other decision makers to whom the results and recommendations are communicated. It generates questions about the system which do not occur under the usual conditions of success analysis. Additionally, the methodology, by facilitating consensus formation processes of groups, promotes team building activities which, in turn, lead to greater productivity.

Quantifying Fault Tree Analysis

Once a fault tree has been constructed, the analysis turns to a determination of a strategic path. A strategic path is a route from a bottom fault to the top fault that identifies the faults that are the most important to overcome in order to improve organizational effectiveness. A strategic path is determined by computing weights for the various faults. The goal is to identify which faults are the most critical in causing organizational ineffectiveness. Because organizational effectiveness is increased as important indicators of ineffectiveness are resolved or eliminated, computing a strategic path through the fault tree allows the analyst to identify the most important problems or faults in the system

that inhibit successful performance. Change efforts can thereby be focused in the most critical areas of the organization.

The weights assigned to faults represent probabilities. In systems safety engineering, these probabilities are a product of one of two major approaches: (1) calculation, or (2) simulation. That is, when working with hardware systems (e.g., a nuclear reactor), there are definite probabilities associated with the occurance of a fault or a failure. The life span of a component part, for example, can be calculated based on past experience with the part, or its life span can be determined by computer simulation (see, for example, Henley and Lynn, 1976). With both of these procedures, however, it is assumed that an objective probability actually exists for each fault, and the analysts' job is to estimate that probability accurately as possible. In behavioral systems (e.g., organizations), however, objective probabilities are not associated with specific faults, and they cannot be determined by calculating past event probabilities or by simulation. Therefore different methods are required in order to assign weights.

The best procedure for determining a strategic path in behavioral systems was introduced by Stephens (1972). It involves the use of consensual expert ratings to estimate (1) the relative contribution or importance of the fault, and (2) the frequency (i.e., urgency) of fault occurrence. The rating of the importance of faults is done via some consensus building approach such as nominal group or delphi techniques according to their relative contributions to a more general fault. A percentage contribution is assigned to the faults on each level of the tree. That is, the weightings of all the contributing faults on one level of one branch of the tree should sum to 1.00. If fault A is caused by

faults B and C. for example, the rating of the importance of faults B and C must sum to 1.0 (i.e., fault B = .6. fault C = .4). Asking individuals to assign quantified values to their ratings is consistent with the advice of Kotler (1970).

> Executives and experts who are asked to put their judgments in the form of numbers tend to give harder thought to the problem, especially if the numbers are a matter of record.
>
> Quantification helps pinpoint the extent and importance of differences among executives with respect to the decision problem. Numbers permit the analyst to perform a sensitivity analysis to determine how much a decision depends on particular differences in judgment (p. 80).

Judgments regarding the frequency of occurrence of the fault are made only for bottom faults. This is because the frequency of occurrence for more general faults (or the urgency with which they must be addressed) is a result of the frequency of the faults on lower levels.[7] Estimates of frequency are produced by having experts assign probabilities to particular faults based on a scale of how often they occur. For example. two possible scales are illustrated in Figure 4. Each fault is rated independently--unlike

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FIGURE 4 ABOUT HERE

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the ratings of relative contribution which are rated in relation to one another--so weights need not sum to 1.0 for each set of contributing faults. The scale used for the ratings depends largely on researcher preference, as long as it makes sense relative to the faults being analyzed.

FIGURE 4 ILLUSTRATION OF TWO FREQUENCY SCALES

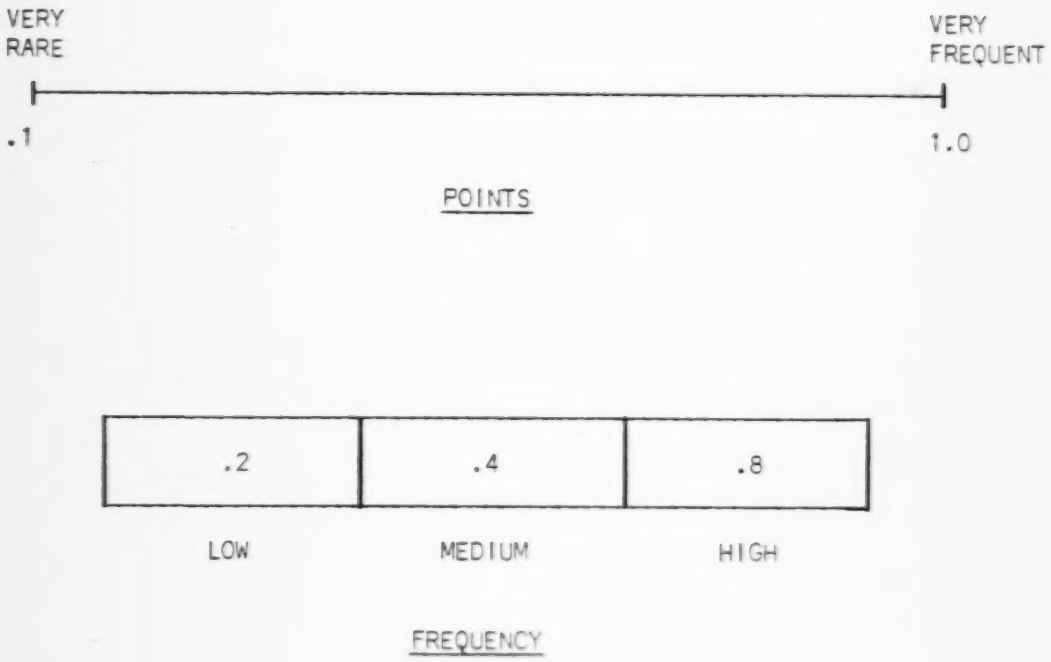

Figure 5 contains an illustration of a fault tree with numerical estimates assigned to each fault. The importance ratings are circled. the frequency ratings are in parentheses. and the overall fault weight is in a box in the figure. The weighting assigned to the bottom

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FIGURE 5 ABOUT HERE

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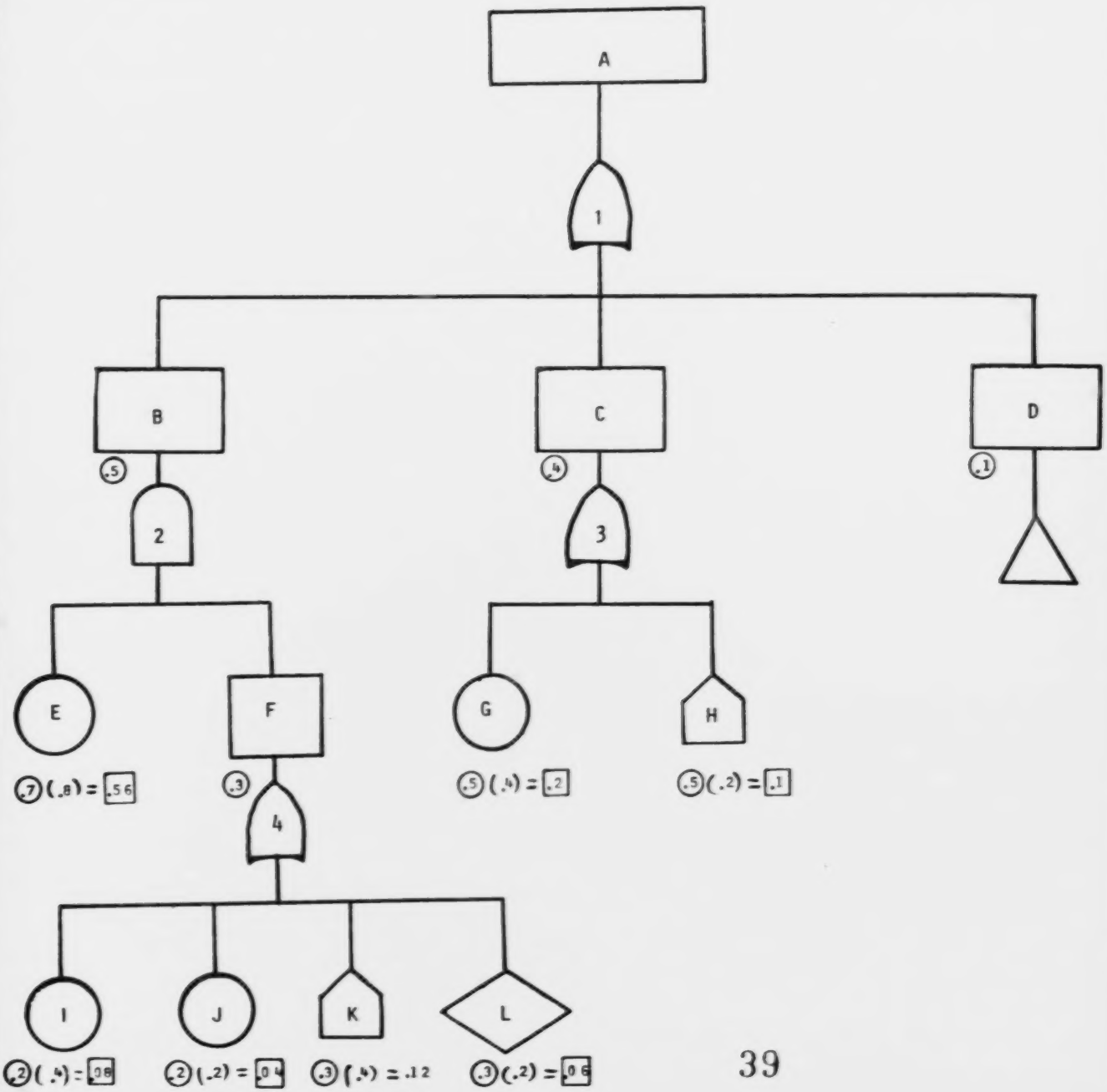
faults is a product of the expert estimates of importance and frequency. It signifies the relative contribution of that particular fault to the occurrence of the fault on the next highest level of the tree. In figure 5, fault B is the most important contributor to fault A when compared to faults C and D. Fault E is a more important contributor to fault B than is fault F. Fault G contributes more to the occurrence of fault C than does fault H. And fault K contributes more to fault F than do faults I. J, or L.

Having weights assigned to each primary fault in the tree now permits the computation of the "strategic path." In safety engineering. the strategic path represents the weakest links in the system. or the areas in which failure is most probable. In organizations. it identifies the interactions among the most important problems in the organization that inhibit organizational effectiveness. Computing the strategic path helps to identify guidelines for implementing future organizational change that eliminate or overcome faults.

Strategic paths are identified by using Boolean algebraic formulas (the algebra of events) to compute weights for each logic gate in the tree. beginning at the lowest levels in the tree. The weights of the individual events are used as the basis for the computations. The

FIGURE 5 ILLUSTRATION OF A WEIGHTED FAULT TREE



algebraic formulas applicable to each of the three different types of logic gates are given in Table 1.

TABLE 1 ABOUT HERE

To illustrate the computation of a strategic path for the elementary fault tree in figure 5, the following computations should be made. assuming that faults G and H and faults I. J, K, and L are nonmutually exclusive--that is. that logic gates 3 and 4 are Inclusive OR gates. Beginning at the bottom of the tree.the following computation is done for logic gate 4:

$$\begin{aligned}SPW = {} & [(.08) + (.04) + (.12) + (.06) - (.08)(.04) - (.08)(.12) \\ & - (.08)(.06) - (.04)(.12) - (.04)(.06) - (.12)(.06) \\ & + (.08)(.04)(.12) + (.08)(.04)(.06) + (.04)(.12) \\ & (.06) - (.08)(.04)(.12)(.06)][.3] = [.267][.3] = .0801\end{aligned}$$

For logic gate 2:

$$SPW = [(.56)(.3)][.2] = [.168][.2] = .0336$$

For logic gate 3:

$$SPW = [(.2) + (.1) - (.2)(.1)][.08] = [.28][.08] = .0224$$

Figure 6 illustrates the primary strategic path and a secondary path (the next most important path) for this elementary fault tree.

FIGURE 6 ABOUT HERE

The advantage of quantifying the strategic paths rather than simply estimating them a priori is that more precise and more accurate analyses result (Kotler. 1970; Wood. Stephens. and Barker, 1979) and a clear strategy for change is specified. In complex fault trees. an awareness of

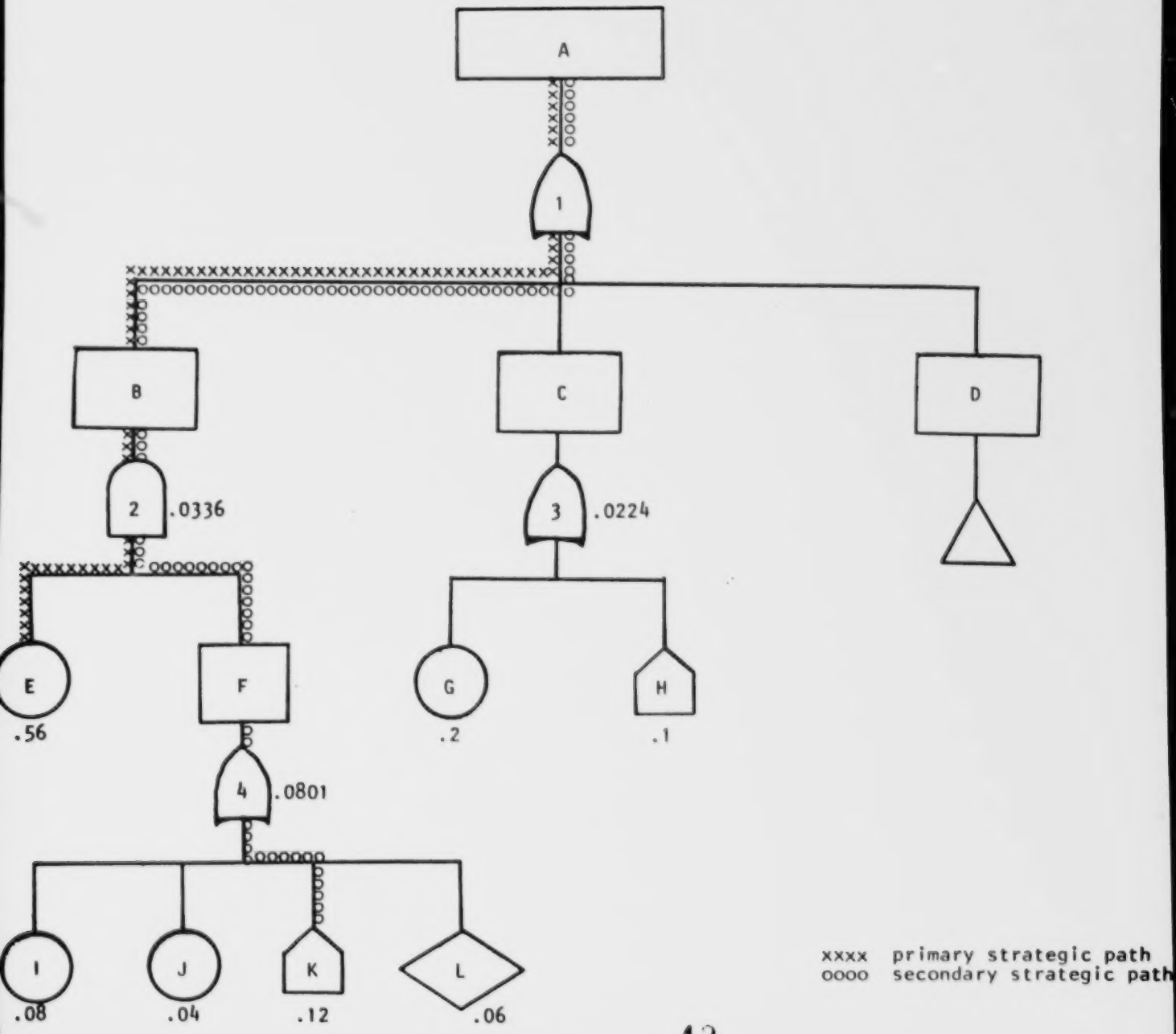
Table 1 Algebraic Formulas for Computing Strategic Path Values for Three Types of Logic Gates

Formula Number	Type of Gate	Formula
1	Exclusive OR	SPW* = P**(Fault$_1$) + P(Fault$_2$) + . . . P(Fault$_N$) • (importance weight of the more general fault)
2	Inclusive OR	SPW = P(Fault$_1$ ∪ Fault$_2$ ∪ . . . Fault$_N$) • (importance weight of the more general fault) SPW (for a gate with 3 faults) = {P(Fault$_1$) + P(Fault$_2$) + P(Fault$_3$) - P(Fault$_1$ ∩ Fault$_2$) - P(Fault$_1$ ∩ Fault$_3$) - P(Fault$_2$ ∩ Fault$_3$) + P(Fault$_1$ ∩ Fault$_2$ ∩ Fault$_3$)} • {importance weight of the more general fault} where P(Fault$_1$ ∩ Fault$_2$ ∩ Fault$_3$) P(Fault$_1$) • P(Fault$_2$) • P(Fault$_3$)
3	AND	SPW = P(Fault$_1$ ∩ Fault$_2$ ∩ . . . Fault$_N$) • (importance weight of the more general fault) SPW = {P(Fault$_1$) • P(Fault$_2$) • . . . P(Fault$_N$)} • {importance weight of the more general fault}

* SPW = Strategic Path Weight

** P = Probability of fault in non-behavioral systems; weight calculates for the fault in behavioral systems.

FIGURE 6 ILLUSTRATION OF A STRATEGIC PATH



where to begin organizational change is not always obvious because of the sheer number of contributing faults in the tree. Whereas, in figure 6 it is relatively easy to map out a strategy of changes without going through the strategic path calculations, this is not generally possible in real organizational assessments. The formulas derived from Boolean algebra, therefore, are designed to make precise the couplings among the faults in the tree and to identify which faults should be overcome first. Therefore if the fault tree has been properly constructed, and the bottom faults are sufficiently precise so as to be alterable, the strategic path maps a way to improve organizational effectiveness by eliminating ineffectiveness.[8]

An Example of an Elementary Fault Tree Analysis

Most fault trees constructed in behavioral systems are composed of several hundred faults that have taken hundreds of person-hours to construct (see Wood, Stephens, and Barker, 1979, for a summary of the size and time involved in producing several different fault tree analyses). Fault trees constructed for hardware systems, however, frequently are much more time consuming. For example, Powers (1974) reported a fault tree constructed for a nuclear power plant requiring over 25 person-years to complete. The example presented below is an abbreviated one with relatively few faults, and it is presented only for the purpose of illustrating the potential usefulness of fault tree analysis in assessing organizational ineffectiveness. The data were derived from an actual investigation of organizations, but many of the faults identified are aggregated among organizations, so this tree does not necessarily identify any one particular organization in that study. The example assumes, therefore, that the faults listed are a product of the consensual judgments of experts in the organization. It is intended to provide a

simplified prototype of an alternative approach to research on organizational effectiveness.

The example analyzes a private, liberal arts college in terms of its indicators of ineffectiveness. It assumes that the following answers have been derived for the seven critical questions:

QUESTION	ANSWER
1. From whose perspective is ineffectiveness being judged?	Members of the dominant coalition inside the organization comprise the relevant constituency.
2. On what domain of activity is the analysis focused?	The overall financial condition of the organization is of concern.
3. What level of analysis is being used?	The organization level of analysis is the focus.
4. What is the purpose for assessing ineffectiveness?	Discovering ways to improve the financial health of the organization and to enhance survival potential is the goal of the strategic constituency.
5. What time frame is being employed?	Analyses are based on present circumstances but with consideration given to contributing factors up to 15 years ago.
6. What type of data are being used in assessing ineffectiveness?	Perceptions of dominant coalition members provide the relevant data for the fault tree.
7. What is the referent against which ineffectiveness is judged?	An objective (ability to meet expenses) referent is appropriate in assessing financial health.

The fault tree identifies "the declining ability of the institution to meet its fiscal obligations" as the priority indicator of ineffectiveness. The assumption is made that if that top fault could be overcome, the organization would be judged to be effective, given the constraints imposed by the seven critical questions. The fault tree

analysis reproduced in Figure 7 identifies four major contributing faults on level 2 of the fault tree. These four faults

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FIGURE 7 ABOUT HERE

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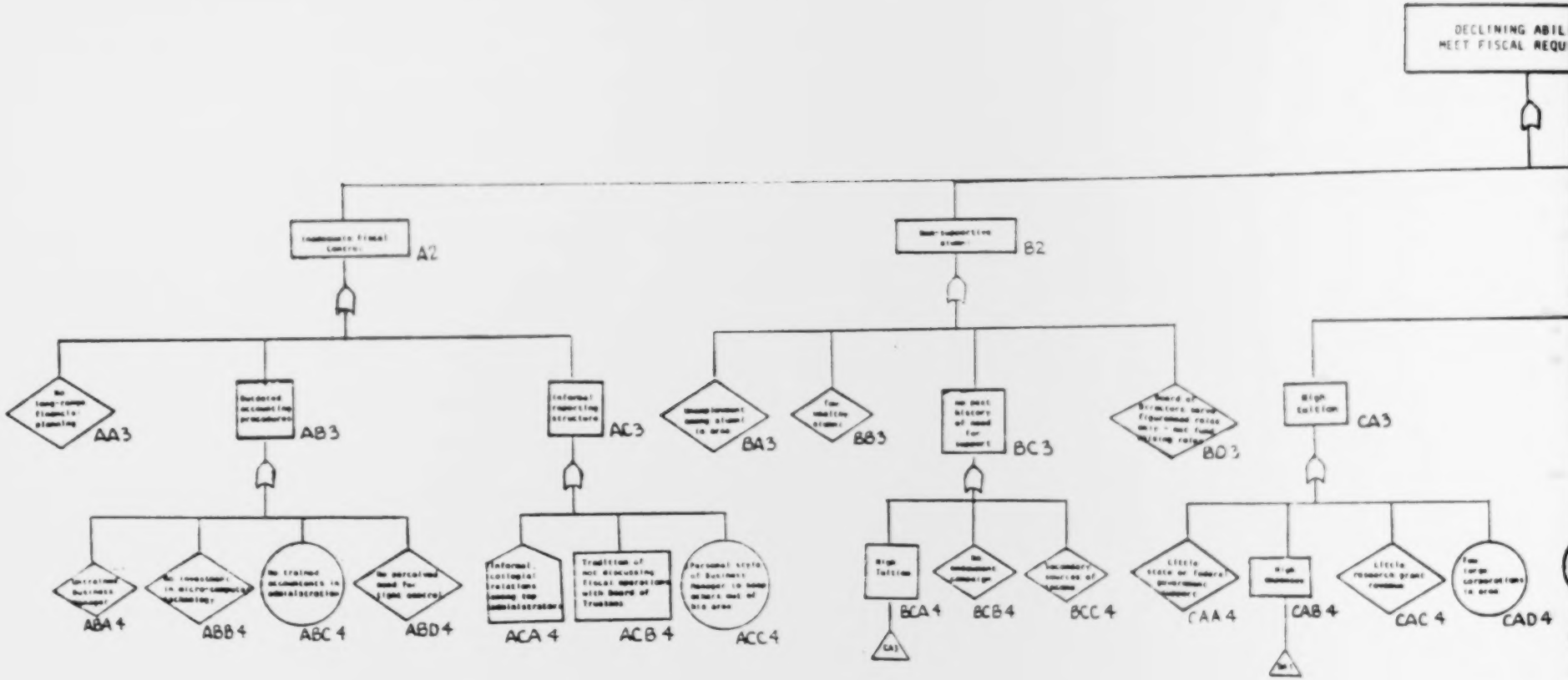
are, in turn, analyzed in terms of their primary or contributing faults, and so on through level 4 of the tree. Many of the faults are drawn as rhombuses not because they could not be analyzed further, but because additional analyses would make the tree too complex for illustrative purposes.

The tree suggests that the four major faults directly contributing to the top fault are: (A2) inadequate fiscal controls, (B2) nonsupportive alumni, (C2) declining enrollments, and (D2) over-expansion in a past growth era. These four faults are connected to the top fault by an inclusive OR gate which signifies that the four faults are not mutually exclusive. Any one of the faults singly or in combination could contribute to the occurrence of the top fault. For example, over-expansion (fault D2) may be a major indicator of ineffectiveness, but it is especially so when accompanied by declining enrollments (fault C2). These four faults constitute level 2 of the fault tree, and they divide the tree into four major branches. The interpretation of the fault tree can be illustrated by examining the faults in branch A.

Branch A. Three primary faults contribute to inadequate fiscal controls--(AA3) no long range financial planning, (AB3) outdated accounting procedures, and (AC3) an informal reporting structure. They are connected to fault (A2) by means of an inclusive OR gate. The first of these faults (AA3) is not analyzed further in this illustration, so it

FIGURE 7 A Prototype Fault Tree Analysis for Organizational Ineffectiveness



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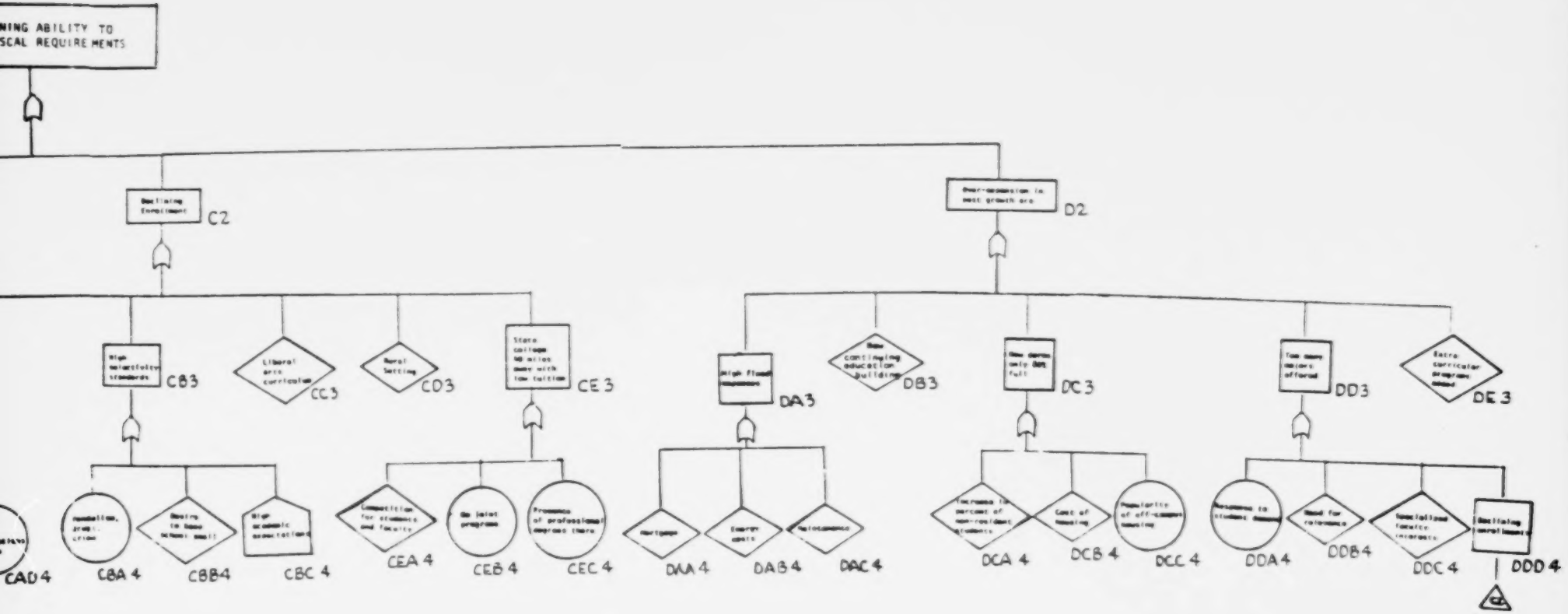

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is diagrammed as a rhombus. The other two faults are analyzed to the fourth level, so they are diagrammed as rectangles. An untrained business manager (ABA4). no investment in micro-computer technology (ABB4). no trained accountants in the administration (ABC4). and no perceived need for tight monetary control (ABD4) are the fourth level faults contributing to fault (AB3)--outdated accounting procedures. That is. fault AB3 is an indicator of ineffectiveness because of these four major contributing factors which could occur singly or in combination. The circled fault. no trained accountants in the administration. indicates a bottom fault that needs no more analysis in order to solve. The other three faults could be analyzed further in the tree but are not for the sake of parsimony.

Three fourth level faults contribute to the presence of the other third level fault (AC3). a loose reporting structure. They are: informal, collegial relations among administrators (ACA4). a tradition of not discussing fiscal operations with the board of trustees (ACB4). and the personal style of the business manager to keep others out of his area (ACC4). Fault (ACA4). an informal, collegial relationship among administrators. is not normally an indicator of ineffectiveness in an organization. However, in this case, it does contribute to the presence of a more general fault in the organization--a loose reporting structure relative to fiscal matters (AC3)--therefore it is diagrammed as a house. The other two contributing faults on level four are not analyzed further--fault (ACC4) because it is a bottom fault and fault (ACB4) because of the need for parsimony in the example.

Explanations of the other branches of the fault tree in figure 7 should not be necessary here in order to make the example clear. However. in an actual assessment of organizational ineffectiveness. the fault tree

would be explained in detail to the dominant coalition members in order for them to rate its accuracy and completeness (i.e., to analyze its validity).

This simplified example points out that fault trees can become extremely large and complex relatively quickly, so computation of primary and secondary strategic paths becomes a necessity. Just analyzing this example partially through only four levels produced 51 primary faults with a variety of relationships existing among them (i.e., some primary faults jointly contribute to more than one general fault. some primary faults coexist with other faults on the same level of the tree. some primary faults independently contribute to organizational ineffectiveness, and so on). These relationships frequently are not evident without a deliberate fault tree analysis. For example, it may not be obvious that the cost of on-campus housing (fault DCB4) is a contributing factor to the ineffectiveness of the organization unless a fault tree is constructed. Furthermore, by addressing some of the more specific faults on level 4, more general faults on the upper levels can be overcome, whereas there may not have been an obvious way to approach them otherwise. By forming joint or coordinated academic programs with the state college in the area (fault CEB4). for example, the institution in this example may overcome the more general fault of declining enrollments (fault C2).

Strategic paths. To determine what is the most productive course of action to take in overcoming or eliminating these major faults, and thereby increasing organizational effectiveness, strategic paths were computed. All bottom faults cannot be addressed at once, and a strategic path indicates which faults should be addressed first in order to have the greatest impact on the top fault. Figure 8 shows the prototype fault tree

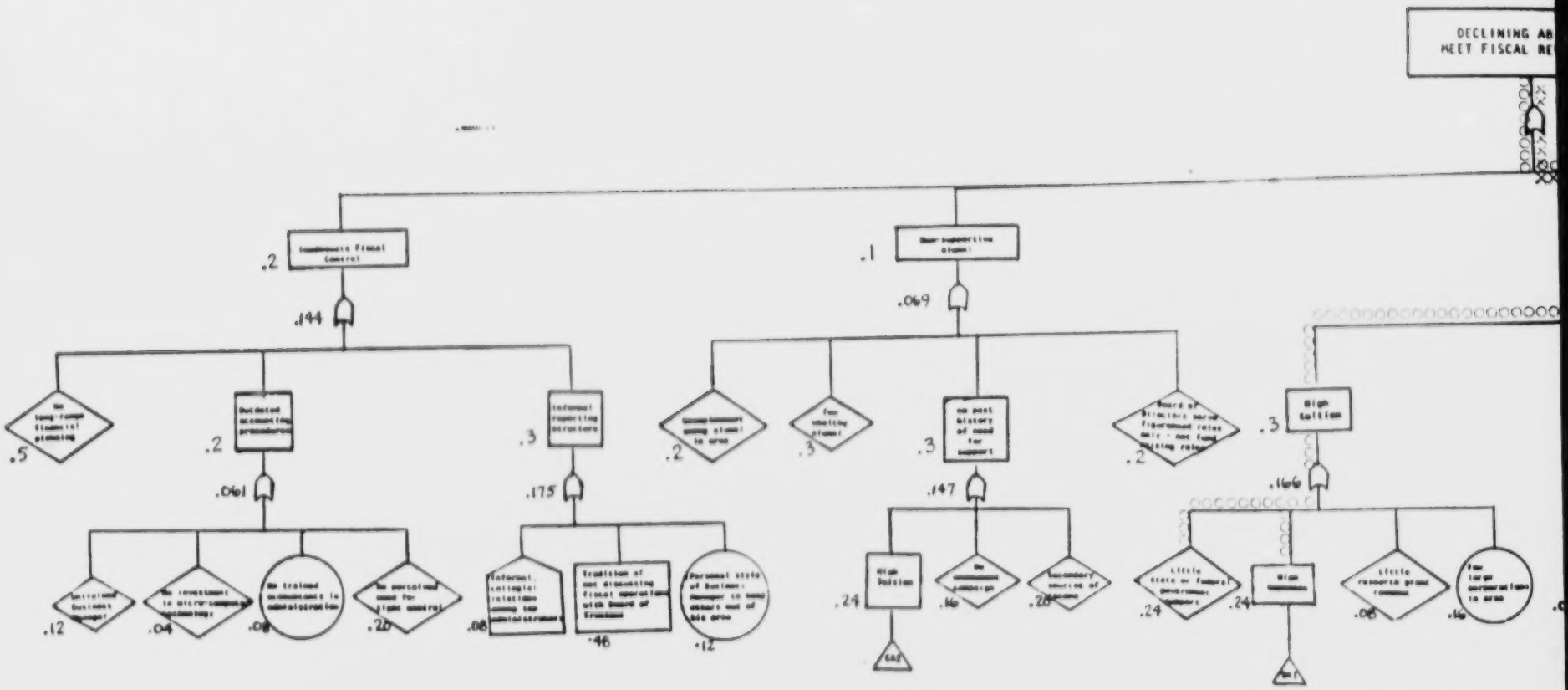
drawn with the hypothetical primary and secondary strategic paths computed. The weightings for each fault used to compute the strategic paths are also provided.

FIGURE 8 ABOUT HERE

If the incomplete analysis present in the fault tree in figure 8 is ignored for the sake of the example, the strategic paths provide valuable information concerning the most productive ways to overcome organizational ineffectiveness. The primary strategic path suggests that by cultivating state or federal government support (e.g., student loans, subsidized programs, tax benefits) and by reducing organization expenses (e.g., energy costs, maintenance), declining enrollments (CA3) can be reversed (e.g., more students can be attracted by offering them financial assistance) which in turn can lead to the elimination of the top fault, the inability to meet financial obligations. These two faults, in other words, are the most important primary faults that contribute to organizational ineffectiveness, and by overcoming them, organizational effectiveness can be significantly improved.

The secondary strategic path in figure 8 specifies the second most important set of contributing faults. It indicates that the second priority for overcoming ineffectiveness is to address high mortgage and energy expenses. As it turns out, this is the same fault that was identified by the primary strategic path. That is because the fault, high expenses, contributes to two different more general faults. In the fault tree, it is located at CAB4 and at DA3. The triangle below CAB4 indicates that this fault is analyzed in more detail at another place in the fault

FIGURE 8 Primary and Secondary Strategic Paths for the Prototype Fault Tree



oooooooooo Primary Strategic Path
xxxxxxxxxx Secondary Strategic Path

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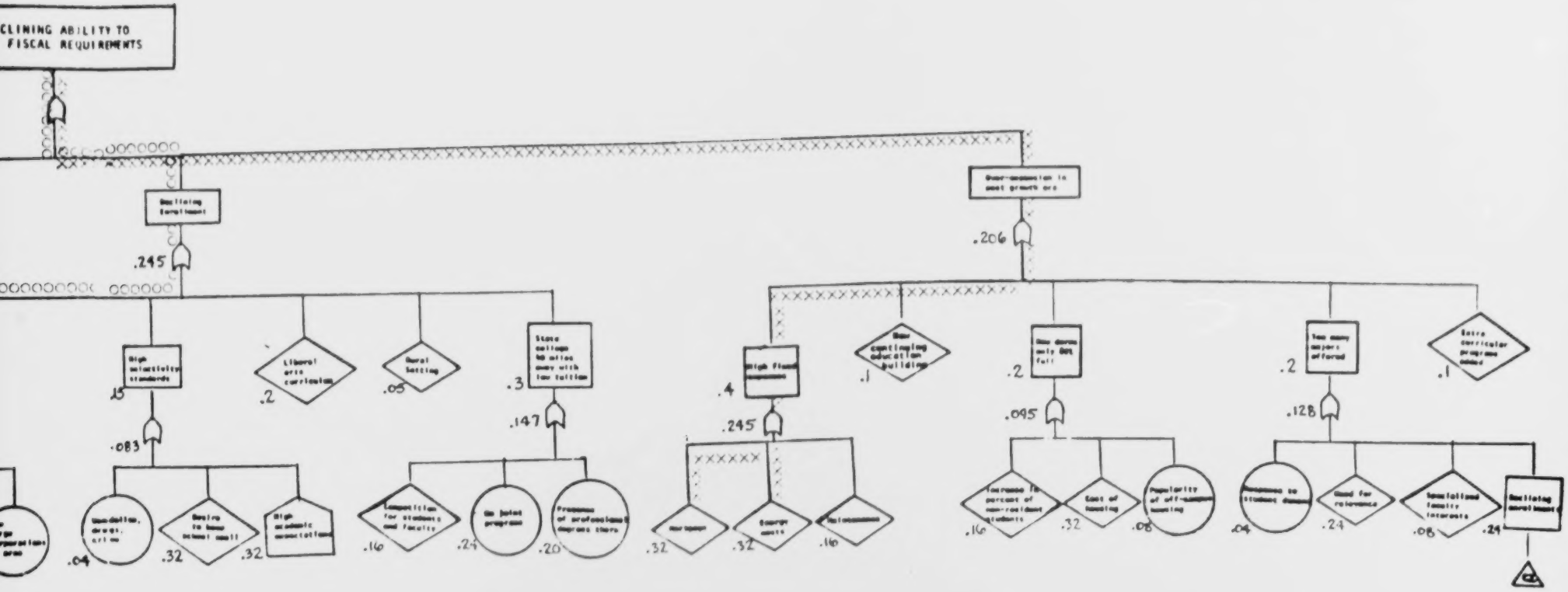

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tree (i.e., at DA3). Consequently, in this example, the prescription for overcoming ineffectiveness and improving organizational performance is clear from both the primary and secondary strategic paths--reduce expenses. This prescription is the first priority and the one with the most potential effect for overcoming organizational ineffectiveness. However, it is not the only fault that should be considered in organizational improvement. Other strategies that focus on other bottom faults also can be considered. but they are not expected to be as powerful in overcoming the top faults as are those along the strategic paths.

The validity of the prescriptions for improving effectiveness rests. of course, on the completeness of the tree and the accuracy of the weights given to the primary faults by the dominant coalition members. The decision as to which constituency(s) to include in assessments of ineffectiveness is. therefore. an important consideration because the weightings of the faults that lead to the strategic paths must result from an understanding of the system being assessed. Expert judgments of the domain being considered, therefore, are likely to prove to be the most valid. Care also should be taken to include a validity check after the fault tree is constructed so that the appropriate constituency can assure that the fault tree is complete. Finally, agreement must be reached within this constituency as to their weightings of the faults in order to increase the probability that the weightings are accurate.

If proper procedures are used in constructing the fault tree. and if consensus is reached regarding ratings. there is evidence to suggest that the judgments regarding faults will be correct. For example, in a classic study of the accuracy of prediction by groups. Kaplan, Skogstad, and Grishick (1950) found that a group decision produced 67 percent accuracy

in predicting social and technological events as opposed to independent judgments and to discussion followed by separate judgments by individuals. which produced only 52 percent accuracy (also see. Dalkey and Helmer, 1963; and Winkler, 1968). No research has been conducted directly on the accuracy or efficacy of fault tree judgments. but it is reasonable to assume, based on past social psychological research, that some confidence in the judgments is warranted given the use of proper procedures.

Summary. In summarizing the procedures used in fault tree analysis when assessing organizational ineffectiveness, the following are the steps that should be followed in sequence.

1. Answer the seven critical questions to limit the scope of the assessment.
2. Determine the top fault by specifying the major (priority) indicator of ineffectiveness in the organization.
3. Identify the primary faults or problems that contribute to the occurrence of that top fault using consensus building methods.
4. Continue the analysis on more specific levels of the tree until a level of specificity is reached that identifies a specific change strategy.
5. Determine weights for the faults in the tree through subjective judgments of importance and frequency.
6. Compute primary and secondary strategic paths through the logic gates.
7. Identify prioritized change strategies for improving organizational effectiveness based on the strategic paths.

Advantages and Disadvantages of Fault Tree Analysis

Defining organizational effectiveness as the absence of indicators of ineffectiveness and then assessing ineffectiveness through means of fault tree analysis presents several advantages over many of the past approaches to effectiveness, but it also may present some disadvantages. Several of the more prominent advantages and disadvantages of this approach are outlined below.

Advantages. One of the most obvious advantages of this approach to organizational effectiveness is that it is easier to generate and to agree on faults, problems, and weaknesses in organizations than strengths or successes. Particularly in complex organizations where goals are difficult to identify, and where there are various preferences among constituencies regarding what the organization should be pursuing, agreement about what the organization should avoid is much more easily specified. Faults are nearer the cognitive surface than are strengths. Just as it is easier to identify what is wrong with a machine than to identify what is right--because faults are aberrations from the expected performance pattern, and their occurrence motivates efforts to re-establish equilibrium--so ineffectiveness is easier to assess than is effectiveness. This approach to assessment essentially narrows and makes more specific the construct space being investigated.

A second advantage is that by including broad participation of organizational members both in the diagnosis and assessment as well as in the identification of strategies for improved effectiveness, the dysfunctional consequences of rigorous research are avoided (see Argyris, 1968). In traditional assessments that rely on questionnaire responses or structured interviews, misinformation or inadequate information, rejection

or ignoring of the findings. second-guessing the study design. and other forms of resistance are common occurrences. In this approach, both analysts and organizational participants learn collaboratively about the criteria under investigation. As Argyris (1968) suggested:

> In our experience the more subjects are involved directly (or through representatives) in planning and designing the research, the more we learn about the best ways to ask questions. the critical questions from the employees' views. the kinds of resistance each research method could generate. and the best way to gain genuine and long-range commitment to the research (p. 194).

Van de Ven and Ferry's (1980) approach to organizational assessment is similar to fault tree analysis in also placing a high value on organization member participation. Both approaches suggest that the process of generating the analysis may be more beneficial than the results of the analysis itself.

A third advantage is that an understanding of the organization and the inter-relationships among subparts is enhanced by this approach. The interrelationships among factors in the organization that contribute to weakness and ineffectiveness are made clearer by engaging in fault tree analysis. The approach is similar to that advocated by Karmiloff-Smith and Inhelder (1975). Hedberg, Nystrom, and Starbuck, (1976). and others when they suggested that if a problem is difficult to solve (i.e., if organizational effectiveness is difficult to assess) the solution is to reformulate the problem, not to reformulate the solution alternatives (i.e., redefine effectiveness and the approach to its assessment). This approach helps overcome some past obstacles in the assessment of effectiveness by reformulating the conceptualization of the problem.

A fourth advantage of this approach is that it combines rigorous analysis with practical application. Most past attempts to assess organizational effectiveness have focused on identifying a point on a scale that characterizes an organization's performance. This fault tree approach not only serves descriptive purposes (i.e., it describes the current state of organizational performance), but it also serves a prescriptive or normative purpose as well (i.e., it generages strategies for improvement). Therefore, improving effectiveness and assessing effectiveness are products of the same analysis. Starbuck and Nystrom (1983) pointed out that, "Organizational effectiveness affords another instance of the general proposition that prescription has to come before understanding. The notion that one should understand organizations before one tries to improve them is backwards [p. 155]." Combining description and prescription in the fault tree analysis of ineffectiveness enhances the understanding of organizations by suggesting strategies for changing them. At the same time, it does not ignore the need for systematic, a priori analysis as well.

A fifth advantage is that this approach can be used for multiple purposes besides assessing current organizational ineffectiveness. For example, identifying strategic paths and determining strategies for change can provide the political justification needed in organizations for reallocation of resources. Taking resources from one area in order to improve another area that is weak is always a sensitive political issue in organizations, especially under conditions where little organizational slack is present. A fault tree analysis can provide a rational justification for implementing such change. Another example is that this approach can be used to assess organizational potentialities as well as

current levels of functioning. Brewer (1983). Mohr (1983). and Nord (1983) implied that evaluations of organizational effectiveness not only should focus on what organizations do produce, but consideration also should be given to what they could produce. A fault tree analysis can be constructed in the future tense and analyzed in terms of what are the major indicators of ineffectiveness that could occur in the organization. Strategies are then recommended to prevent organizational ineffectiveness from occurring. As an illustration of this use. Zarzycki (1971) suggested:

> . . . .fault tree analysis has value. . . .In making an analyst aware of the possible occurrences which might lead to production losses. The awareness gained from a fault tree is a major step toward future loss control [p. 11].

Disadvantages. Of course, focusing on organizational ineffectiveness through fault tree analysis may have drawbacks. It is not an approach that resolves all of the problems surrounding past research on organizational effectiveness. Five potential disadvantages are pointed out in the paragraphs below.

First. information may not exist regarding all the organization's major faults. Contributing faults on lower levels of a fault tree may be difficult to uncover, and underlying causes of problems may not be apparent or may be inaccurately assumed. Identifying some faults may even be the result of political processes. so that different fault trees may be produced depending on which group is asked. For example, constituencies may identify only those faults that place blame on other groups or on uncontrollable factors so as to relieve themselves of responsibility for weaknesses in the organization or of a need for change. Disowning

responsibility for failure by projecting it externally is a common occurrence in the attribution process. Because judging ineffectiveness is based as much on values and preferences as is judging effectiveness, differences existing in individual and constituency perspectives must be considered in all assessments.

Second, constructing accurate fault trees may take a large number of hours and the involvement of many people. It is certainly not as easy as sending out a questionnaire to managers in a sample of organizations and tabulating the results. Moreover, fault tree analysis, as currently developed, is limited to one unit of analysis, and comparisons among organizations require separate fault trees for each organization. The purpose of fault tree analysis focuses more on improving a single unit than on making comparisons among multiple units. Comparison among units is difficult unless similar faults are identified in the trees. The amount of time and effort required to analyze and compare the ineffectiveness of multiple units of analysis may be prohibitive.

Third, there is no guarantee that solving a problem on a lower level of the fault tree will automatically solve the problem to which it contributes on an upper level of the tree. Whereas fault tree analysis can identify the faults that are most tightly coupled in the tree, and that contribute most to ineffectiveness, it does not guarantee that a domino effect will result from solving one bottom fault. Moreover, no empirical work has been published to date demonstrating that the faults identified along the strategic path are, in fact, the most powerful in overcoming the top fault. Anecdotal evidence has appeared in several articles. But it is not certain that intuitive judgments or a random selection of solutions would not be just as efficacious as rigorous fault

tree analysis for overcoming or eliminating the top fault. This is an area where further research is needed.

Fourth, this approach does not pay attention to organizational strengths; instead, it pays attention to organizational weakness. Some policy analysts suggest that organizations are better off focusing resources and organizational energies on what the organization does well. That focus advocates capitalizing on what is successful already. Resources should not be plowed into problem areas, according to that view. On the other hand, this approach takes the opposite stance by defining effectiveness as the absence of ineffectiveness. It advocates concentrating on organizational weaknesses in order to overcome them, which implies a reallocation of resources into problematic areas. The relative efficacy of overcoming weaknesses versus magnifying strengths is another unknown but fruitful area for future research.

Fifth, some kinds of organizations function well because they are <u>not</u> understood very well. These organizations have loose coupling, non-existent or fuzzy goals, fluid structures, etc. The advantage of this kind of design is that organizational discretion is maximized and multiple demands can be addressed at once. Two problems may occur in these organizations, however, because of fault tree analysis. First, relationships among faults that are identified by fault tree analysis may be too loosely coupled and dynamic for a reliable analysis. Second, fault tree analysis, because of its relatively fine-grained analysis, may destroy some of the mystique of these organizations. Enarson (1981) illustrated the problem of this phenomenon with this statement: "The enchantment with the university is at a low ebb when the number of graduates is at an all-time high. <u>We are known too well</u>." Just as the

popularity of politicians usually wanes when they become well known by the public--i.e., when the mystique wears off--so some organizations may resist fault tree analysis because it exposes them in too much detail.

Despite these potential disadvantages, however, the analysis of organizational ineffectiveness through a fault tree presents a potentially useful alternative to the assessment of organizational performance. In the section below, this approach to effectiveness is compared to other well-known approaches and suggestions are made regarding the usefulness of each.

A Comparison of Models of Effectiveness

This alternative approach to organizational effectiveness does not aspire to replace other major approaches used in the past. Instead it should be viewed as a useful addition to the repertoire of models. Assessing organizational ineffectiveness provides some advantages that are not present in other approaches, and it helps address some of the major problems with past organizational effectiveness literature. What is crucial for the analyst to be aware of in selecting an approach to effectiveness, however, is when one model is more appropriate than another; or in the present case, under what conditions is assessing ineffectiveness by means of fault tree analysis the most appropriate alternative? Table 2 summarizes seven major models of organizational effectiveness that have received attention in the literature (see Cameron & Whetten, 1983, for other models of effectiveness that are based on a variety of academic disciplines). The table also suggests when each model is appropriate for use in assessments. A basic point of that table, and of this essay, is that multiple models of effectiveness not only are

necessary, but that different perspectives are very useful under different conditions.

TABLE 2 ABOUT HERE

The goal model has received wider attention than any other approach to effectiveness, and more writers have argued that it represents the universal model of effectiveness than any other model (see Bluedorn, 1980; Campbell, 1977; Scott, 1977). Its usefulness is limited, however, by its reliance on measurable, time-bound goals. Because many organizations cannot be characterized by such goals, analysts should select this model only when it is clear what the end result should be, when it should occur, and who says so.

The system resource model was developed in the early 1960's in reaction to what was perceived as an over-reliance on goals (see Georgopolous & Tannenbaum, 1957; and Yuchtman & Seashore, 1967). This model emphasizes the interchange between the organization and its environment, whereas the goal model largely considers organizational goals irrespective of environmental context. Particular attention is given in the system resource model to the acquisition of needed resources. This model is appropriate when there is a clear connection between resources received by the organization and the primary task of the organization. An organization that simply gathers resources and stores them, for example, or that increases organizational fat by obtaining irrelevant resources would not be judged to be effective. Resource acquisition, therefore, must be clearly connected to organizational outcomes.

Table 2 A Comparison Among Major Models of Organizational Effectiveness

Model	Definition	When Useful
	An organization is effective to the extent that . . .	The model is the model of choice when . . .
Goal Model	it accomplishes its stated goals.	goals are clear, time-bound, and measurable.
System-Resource Model	it acquires needed resources.	a clear connection exists between inputs and outputs.
Internal Process Model	it has an absence of internal strain, with smooth internal functioning.	a clear connection exists between organizational processes and the primary task.
Strategic-Constituencies Model	all strategic constituencies are at least minimally satisfied.	constituencies have powerful influence on the organization (as in times of little organizational slack), and it must respond to demands.
Competing Values Model	the emphasis of the organization in four major areas matches constituent preferences.	the organization is unclear about its own emphases, or changes in criteria over time are of interest.
Legitimacy Model	it survives as a result of engaging in legitimate activities.	the survival or decline and demise among organizations must be assessed.
Ineffectiveness Model	there is an absence of characteristics of ineffectiveness.	criteria of effectiveness are unclear, or strategies for organizational improvement are needed.

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The internal process model emerged largely from the human resource development (HRD) and organization development (OD) perspectives. The focus is on the interaction of individuals within the organization in terms of its participativeness, humanitarianism, absence of strain, and so forth. This model is based on a normative set of principles describing how an organization should function to provide maximum potential for human growth and development (see Likert, 1967, and Argyris, 1962 for examples.) It is most appropriate when the organizational processes under consideration are closely associated with the primary production task of the organization (Rice, 1965). An extremely smooth, but subversive communication system in an organization, for example, would indicate good process but an absence of organizational effectiveness.

The strategic constituencies model arose in the 1970's as a result of more sophisticated analyses of the external environments of organizations. Several different versions of this model have been introduced (Connelly, Conlon, & Deutsch, 1980; Keeley, 1978; Miles, 1980; Pennings and Goodman, 1977; Zammuto, 1982), but each places the satisfaction of the demands of various constituencies of the organization as the primary concern. This model is most appropriate when constituencies have powerful influence on what the organization does or when an organization's actions are largely reactive to strategic constituency demands. The mission or the domain of some organizations is mandated by external special interest groups; by contrast, other organizations are more proactive and autonomous in their activities. Similarly, some organizations exist in an environment where certain constituencies clearly are more powerful than others, whereas other organizations have no clear powerful constituency. In the former,

the strategic-constituencies model would be a useful approach. In the latter, the model would not be as appropriate.

The competing values model is based on the notion that individuals who judge organizational effectiveness do so by making trade-offs on two general value dimensions. These dimensions are assumed to represent core values that are at the center of human judgment. One is a trade-off between flexibility (freedom, fluidity) and control (constraint, determinism). The other is a trade-off between emphasizing people concerns over organizational concerns, or vice versa. Making those trade-offs in judging effectiveness results in four major emphases on criteria of effectiveness. Organizations have been found to differ substantially on which criteria they emphasize (see Quinn & Rohrbaugh, 1981, 1982, for a more complete explanation). Because of its emphasis on trade-offs in criteria and the shifts that occur in organizations' profiles, this model is most appropriate when determining what changes occur in relevant criteria of effectiveness over time, and when there is a need to help the organization itself understand its major areas of emphasis.

The recently introduced legitimacy model is frequently associated with the population ecology perspective in that organizational survival is the ultimate aim. Organizations strive for legitimacy with the external public in order to enhance their longevity and to avoid being selected out of the environment (i.e., demise). Since doing the right thing is far more important than doing things right in this perspective, the model is most appropriate on macro levels of analysis when determining which organizations survive and which decline or die.

The model of ineffectiveness introduced in this essay is most appropriate when criteria of effectiveness either cannot be identified or cannot be agreed upon, and when there is a need to systematically develop strategies for organizational improvement. None of the other models in table 2 serve these two functions.

Conclusion

There have been few areas of agreement in the literature of organizational effectiveness thus far. Some authors have attributed this condition to the fact that effectiveness is a political concept (Kanter & Brinkerhoff, 1981), that organizations have many effectivenesses (Cameron, 1980; Hrebiniak, 1978), that effectiveness has been inadequately measured (Steers, 1977), and even that effectiveness is largely a nonsensical term (Goodman, Atkin, & Schoorman, 1979). Despite these obstacles, however, this essay has indicated some points in which concensus is possible regarding the construct of effectiveness. The following statements of conclusion represent some of those major points.

1. Organizational effectiveness is a construct with unspecified boundaries. It is impossible, therefore, to produce one model of effectiveness that encompasses all relevant criteria.
2. Different conceptualizations of organizations produce different models of organizational effectiveness. Because organizational conceptualizations are interested in completeness more than in accuracy, multiple conceptualizations are both possible and desirable.
3. Criteria for judging organizational effectiveness are founded in the preferences and values of individuals. Individual differences preclude concensus regarding one universal set of criteria.

4. Criteria of effectiveness are time constrained, so that depending on when effectiveness is assessed, or depending on whether a long-term view or a short-term view is taken, criteria differ in their relevance.
5. It is easier for individuals to identify and agree on criteria of ineffectiveness than criteria of effectiveness. Problems and faults in organizations serve to circumscribe the construct space of ineffectiveness more narrowly than successes and desirable outcomes circumscribe effectiveness.
6. Different models of organizational effectiveness are useful in different circumstances. None of the major models of effectiveness supercedes all others, so that each model possesses some legitimacy in organizational assessments.
7. Researchers can make fruitful additions to the literature of organizational effectiveness by selecting a model of effectiveness that is congruent with the specific circumstances being considered. Limiting the scope of any investigation by means of the seven critical questions also is a necessity.
8. Identifying strategies for improving organizational effectiveness is more precisely done by analyzing organizational ineffectiveness as opposed to organizational effectiveness.

FOOTNOTES

[1] Any model of organization claimed to be complete would have to account for all phenomena that influence and are influenced by organizational behavior. Because those phenomena are time dependent (e.g., some factors or their effects may go unrecognized until they are uncovered by the proposal of an alternative model; Kuhn. 1962). no single model could account for all relevant variables. A model claiming completeness would also have to claim accuracy. and unlike the physical sciences where most relationships are governed by immutable natural forces (e.g., gravity). such forces--and therefore constant. consistent relationships--are very rare in organizational behavior. No model, therefore. could be judged to be both complete and accurate all the time.

[2] For many constructs in organizational behavior, however, researchers have narrowed the construct space by agreeing on a common set of indicators that serve to bound the construct space. Consensus circumscribes constructs. For effectiveness. no such consensus of criteria exists. and therefore little narrowing has occurred.

[3] There may be several reasons why faults in organizations are easier to identify and to reach consensus on than strengths. For example. the effects of faults are generally more obvious than are the effects of strengths in an organization. When things go wrong, it is more obvious than when things are smooth-running. Individuals are more uncomfortable in the presence of organizational faults and mistakes than they are comfortable when things are right. That is. faults

produce dissatisfaction and effort on the part of individuals to re-establish equilibrium (effectiveness). An absence of faults, on the other hand, does not necessarily produce high satisfaction. The presence of criteria of effectiveness produce satisfaction, but these criteria are qualitatively different from criteria of ineffectiveness. (See footnote 4.) Theories of cognitive dissonance suggest that individuals are motivated to perform cognitive work only when they experience dissonance or discrepancy. Hence, faults, which produce discrepancies, are more readily evident in the environment than are strengths.

[4] The assessment of ineffectiveness is not just the flip-side of assessments of effectiveness. Qualitative differences exist. In assessing ineffectiveness, for example, the assumption is made that the organization is effective to begin with, and the task of the analyst is to identify the factors that diminish effectiveness. In assessing effectiveness in the traditional way, the organization is assumed to be ineffective, and then evidence for effectiveness (i.e., criteria of good performance) are sought. This is similar to the difference between health and illness. One can look for evidence of good health (effectiveness) or for evidence of illness (ineffectiveness). The criteria that indicate each condition are not just the converse of one another. They are qualitatively different. A model of ineffectiveness and its causes is not likely to be just an absence of criteria of effectiveness, therefore. A different set of factors will be present in each model, not just the absence of the other models factors. This definition of organizational effectiveness is qualitatively different, therefore, from the approaches to effectiveness taken up to now.

[5] It is important to keep in mind that fault tree analysis is a tool for analyzing organizational effectiveness. It is not a model of organizations in and of itself.

[6] A computer program has been designed to handle up to 16 levels of fault tree inputs in behaviorally oriented systems. (Developed by Kent Stephens at Brigham Young University.)

[7] It may be the case that not all frequently occurring small faults contribute to the occurrence of a larger fault. But if the fault tree is constructed properly, where the faults on the lower levels of the tree are identified as having a causal relationship to the faults immediately above them, the logic of this computational formula holds.

[8] The power of fault tree analysis may be enhanced if it is used as an iterative process. That is, when strategies have been employed to eliminate criteria of ineffectiveness, the relative weightings of various faults in the tree may change. A new analysis may uncover a new strategic path that was not identified in the earlier fault tree. Continuous self-analysis in an organization, then, could enhance the self-design and self-renewal process.

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